DOCUMENT RESUME

ED 280 456 IR 012 592

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TITLE Choosing the Ethical Path to Excellence in Computer Education.
PUB DATE Mar 86
NOTE 10p.; Paper presented at the Annual Conference on Microcomputers in Education (6th, Tempe, AZ, March 12-14, 1986).
PUB TYPE Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Software; *Computer Uses in Education; Elementary Secondary Education; Higher Education; *Instructional Improvement; Learning Theories; Mathematics Curriculum; *Mathematics Education; Research Needs; School Districts; *Teacher Education; Teacher Role

ABSTRACT

National attention has been placed on the need for the improvement of education, and teachers must become aware of the capabilities of computers for improving classroom instruction, choose appropriate software, and have a sufficient number of computers to support the software. The quality of educational computing depends on the quality of software selected and the way in which it is integrated into the curriculum. Universities have the responsibility for insuring that students planning to teach and inservice teachers have experience with software, programming, and learning theory related to computer education. School districts should establish committees to review software, and provide both the opportunity and the hardware for teachers to maintain computer instruction skills. Each district needs a computer education specialist, and each school needs at least one similar specialist to relate the needs and goals of the district to individual teachers. As the use of computers and other information technologies reshapes the fundamental methods of teaching and doing mathematics, developers of high school mathematics curriculum must consider both the changing preparation of their entering students and the changing college and work environments their graduates will enter. Future research should address such questions as ways of using technology to help students model the world better and become more skilled at solving world problems. Another question relates to the mental models people hold of how computers function and how their notions affect their learning about computing. Nine references are listed. (MES)

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Choosing the Ethical Path to Excellence in Computer Education

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Abstract

Excellence in Education is increasingly becoming a national focus, aimed at improving the quality of public education in this country. In the sense of going beyond the existing standards to new and higher standards, the goal towards excellence must include a greater use of computers in education. Classroom teachers must recognize the capability of the computer as a tool for instruction. It is also ethical for today's classroom teachers to be informed and to maintain an awareness of the computer uses that are appropriate for classroom instruction.

National Focus

National attention has been placed on the need for the improvement of education in this country. The National Commission on Excellence in Education (1983) and The Task Force on Education for Economic Growth (1983) have challenged all educators to improve curriculum by setting higher academic standards.

In many cases, higher standards in education can be achieved by using existing technology where appropriate and applicable in the instructional process. Every teacher must become aware of the capabilities that computers offer for improving instruction in their classroom. Teachers need

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assess to quality software that is appropriate for their particular classroom use and must have a sufficient number of computers to support it. They must, however, be given a choice of the specific software to use and must have a choice in the manner in which it is to be used. Classroom teachers must be given the opportunity to observe demonstrations of instructional software and participate in software workshops that are designed to prepare them for classroom computer use.

Quality of Software

The overall quality of software presently available is a substantial improvement over that which was available three or four years ago. We have not provided, however, software publishers with the creative insights concerning needed content or effective uses of software in the classroom.

The quality of educational computing in a school is going to depend on the quality of software selected for use in that school and on the way in which the use of that software is integrated into the overall curriculum. Most schools are buying software without the kind of discrimination they ought to be using.

Purchasing appropriate and quality computer software is not an easy task. It is more confusing than purchasing textbooks, workbooks, films, and tapes. Not only due to the large number but the products are more difficult to assess and to select. There are, for instance, approximately 100 textbook publishers, 20 of which dominate the market. In comparison, there are approximately 700 educational software companies with 7,000 to 10,000 software packages (Komaski, 1984). Software packages are difficult to evaluate and many software companies refuse to grant previewing priviledges. The present scarcity of high-quality products, relative to the number of software packages on the market, is to some extent a function of the young age of the field. The process of developing excellent, high quality instructional software is time consuming and will require additional years in order to obtain the number of quality software programs that are needed for classroom instruction. The time required, however, will be related to the number of people involved and the quality of their skills.

Approved software packages should be experimentally tested within a classroom setting. The selected software should demonstrate to be an effective means of facilitating classroom instruction and ultimately increasing student achievement.

Presently, only a small percentage of classroom teachers have exposure to educational software. All teachers should have the opportunity to view and become informed about software that is appropriate for their particular classroom needs.

Parents' Positions

Parents of school age children are looking to the schools to make learning with computers an integral part of the educational process. Many of these parents have high potential expectations. In many cases, the parents have purchased machines for their children to use for school assignments (Komaski, 1984).

University's Role

The university's responsibility to preservice education includes the providing of experiences and instruction related to the following:

1. Student interaction with software. All students preparing to teach should have some experience with the existing software in the academic area(s) in which they seek certification. Students should have experience with a variety of software programs and should be given enough information to enable them to evaluate software from an appropriate set of standards.

2. Student interation with computer programming. All students should have some experience with a programming language. The degree of involvement and the language that is most appropriate depends upon the particular course and grade level in which the student is preparing to teach.

3. Instruction in learning theory as related to computer education. Such theories could be contained in an existing course of learning theory or a course related to computers in education.

The university also has a responsibility to assist in the training of inservice teachers by providing graduate coursework and conducting workshops related to the three previously describe areas. That is, the university should provide computing experiences and instruction in learning theory to all teachers. NCTM with financial assistance from the National Science Foundation is presently taking an active role in this direction for computers in mathematics classrooms.

Many teachers are becoming increasingly sophisticated in their understanding and aspirations for computer use in the curriculum and for the computer knowledge of their students. Greatest steps in the past three to four years in regard to computers in education has been inservice education (DeVault & Harvey, 1985).

School District's Role

Individual school districts should establish committees for each academic area with the sole purpose of reviewing and evaluating software. Each software committee should provide the individual teacher in the district with a description of appropriate software and the topic(s) in which each software package can be used for instruction. In order to provide continuity and compatibility between textbook and software, the software evaluation committee should meet periodically with the textbook evaluation committee for each of the academic areas.

Reasons for utilizing computer technology with regard to its relationship to learning theory and the instructional needs of the individual student should be identified. These reasons should be used by the teacher in making proper technological choices that will assist in acheiving the goal of instructional excellence. To achieve this goal, each teacher should have the opportunity to maintain state of the art knowledge and skills related to computer instruction. Microcomputers should be made available for independent study projects and extra curricular activities (Zuk & Stilwell, 1984).

The individual classroom teacher is usually not required by the school district to evaluate textbooks for district-wide adoption or for supplementing classroom instruction. Similarly, each individual teacher cannot be required to

personally obtain and evaluate instructional software.

Each school district should support the use of software or develop software exchange and dissimination systems in each state. It is important to call upon the knowledge base of those who have experience and proven competence in utilizing microcomputers in classrooms.

As programs in educational computing develop and expand, internal and external evaluations will be needed on both immediate and long term program impact. The district must be careful not to trade in the quality of the instruction program due to cost.

School districts should provide general training in educational computing for its staff. Such staff development is time consuming, expensive, and the most complex part of the process of implementing computers into the instructional program of a school. Staff development, however, is also an essential element for improving instruction.

Computing Specialists

Each school district needs a computer education specialist with competencies in the areas of curriculum foundation, use and application of computers in the instructional environment, knowledge of learning theories and how they apply to computer use in the classroom, understanding of the learning process, programming ability and ability to evaluate computing program (Stevens, 1984).

In addition to the district-wide computing specialist, each building or each academic department within each building of the district needs at least one similar specialist to relate the needs and goals of the district to the individual classroom teachers. Such a computer resource teacher should be able to serve as a technical advisor for all teachers. For example, a mathematics/computer resource teacher is needed who can provide leadership in helping teachers make appropriate use of computing decisions in mathematics education. A similar person in needed in each of the other academic areas.

Mathematics Application

The Educational Technology Center (ETC) of the Harvard Graduate School of Education, under the direction of Judah Schwartz, received a $7.7 million grant from the National Institute of Education to finds mays of using technology in mathematics, science, and computer science. The software package titled, "The Geometric Supposer", developed by the project and available for instructional use by Sunburst Communications, exemplifies software that puts the student in control. With this concept, the student leads the "conversation" and the computer simply displays the consequences of the student's actions. A concept greatly removed from Computer Assisted Instruction (CAI), in which control is contained in the contents of the computer program. CAI software is not helpful in serving the idiosyncratic needs of individual students, nor can it deal with the inventive child (Brady & Levine, 1985).

Applications of computers and other information technologies are reshaping the fundamental methods of doing and teaching mathematics. Computers offer powerful and new applications to old problems and access to entirely new branches of mathematics. Applications of these same capabilities to instruction are bringing major changes to mathematics classrooms and to the role of mathematics teachers (NCTM, 1985). One influence of technology on mathematics education is its potential to shift the focus of instruction from emphasis on manipulative skills to an emphasis on developing concepts, relationships, structures, and problem solving skills.

Developers of senior high school mathematics curriculum must consider both the changing preparation of their entering students and the changing college and work environment their graduates will enter. For instance, computing is changing the role of calculus and its traditional prerequisite subjects. Content priorities and approaches to topics in high school geometry should be reconsidered in light of computer graphics and their applications. One such approach was the previously mentioned project by Schwartz at ETC. The skill objectives of algebra must be reassessed to identify those procedures more easily done by computer. Computers offer a dynamic electronic chalkboard for the demonstration of mathematical

ideas. As laboratory tools, they assist in the exploration and discovery of concepts and the practice of skills.

The mathematics content and methods courses in teacher education must be examined and restructured to give more attention to priority content areas and to make computer use an integral part of the such courses. Preservice mathematics teacher education programs must be restructures to prepare teachers for their new role.

Questions for Research

In an interview with Brady and Levine (1985), Judan Schwartz indicated some of the numerous questions we must ask with regard to technology use in education. One such question involves ways to use technology to help students model the world better and thus become more skilled at solving world problems. Another question relates the mental models people hold of how computers function, and how their notions affect this learning about computing.

Other research questions that need to be addressed are the following:

1. What are the long-range, cumulative effects of computer use for instruction?
2. How are users' influenced by computer's effects?
3. What are the unique computer capabilities?
4. What degree of transfer of learning takes place from computer to non-computer context?
5. What is the role of computers in education and role of the schools in the computer age? (Salomon, 1984)

In order to make full use of computers' potential, schools must be radically changed, and this is unlikely. Due to public pressure and the need to maintain literacy, the past has shown that schools are quick to adopt new technologies. Once introduced, however, the schools usually do not much change. The changes that will take place, however, must be based on ethical choices.

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